

# RECLAMATION

*Managing Water in the West*

Draft Final Infrastructure Design Report

## Lake Berryessa Concession Concept Plans

Napa County, California



U.S. Department of the Interior  
Bureau of Reclamation  
Sacramento, California

June 2014

## **Mission Statements**

The mission of the Department of the Interior is to protect and provide access to our Nation's natural and cultural heritage and honor our trust responsibilities to Indian Tribes and our commitments to island communities.

The mission of the Bureau of Reclamation is to manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public.

# Lake Berryessa Concession Concept Plans

**Draft Final Conceptual Infrastructure Design Report  
Napa County, California**

*Prepared by*

**United States Department of the Interior  
Bureau of Reclamation  
Mid Pacific Region, Central California Area Office**



**U.S. Department of the Interior  
Bureau of Reclamation  
Sacramento, California**

**June 2014**

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## Abbreviations and Acronyms

ADA	Americans with Disabilities Act
BOD	Biological oxygen demand
CMU	Concrete masonry units
Ft	Feet
Gpd	Gallons per day
Gpm	Gallons per minute
HDPE	High-density polyethylene
lbs	pounds
MG	Million gallons
mg/l	milligrams per liter
MSL	Mean Sea Level
NBRID	Napa Berryessa Resort Improvement District
NFPA	National Fire Protection Association
ppm	Parts per million
psi	Pounds per square inch
PVC	Polyvinyl chloride
RAMP	Reservoir Area Management Plan
Reclamation	Bureau of Reclamation
ROD	Record of Decision
RV	Recreational Vehicle
SF	Square feet
TN	Total nitrogen
VSP	Visitors Service Plan



# Chapter 1

## Introduction

The U.S. Department of the Interior, Bureau of Reclamation (Reclamation) is undertaking the Lake Berryessa Concession Concepts project to assess the market demand and future needs for outdoor recreation at Lake Berryessa. The goal is to assess market demand for recreation at Lake Berryessa, develop conceptual site design layouts of facilities with associated infrastructure to a 30 percent design level, and evaluate the financial feasibility of the proposed facilities and services. This project, combined with Reclamation's other commercial service planning efforts at Lake Berryessa, will culminate in the development and management of necessary and appropriate long-term recreation facilities and services at Lake Berryessa.

### 1.1 Lake Berryessa

Lake Berryessa is part of the Solano Project, a federal water project owned by Reclamation, which provides municipal and irrigation water to Solano County. The reservoir is also used for flood control, hydropower, fish and wildlife, and recreation. The reservoir is located in Napa County, 70 miles northeast of San Francisco, 65 miles west of Sacramento, and approximately 20 miles from the center of Napa Valley's wine country. Five existing recreation areas are the subject of this report:

- Putah Canyon
- Monticello Shores
- Berryessa Point
- Spanish Flat
- Steele Canyon

Figure 1-1 shows the location of the recreation areas at Lake Berryessa.



Figure 1-1. Lake Berryessa Recreation Areas

## **1.2 Conceptual Infrastructure Design Scope**

The scope of the Conceptual Infrastructure Design task is to develop an appropriate architectural theme, construction methods and materials as well as determine an appropriate level of utility service and infrastructure to support the recreational uses. The Conceptual Infrastructure Design elements will be used to develop conceptual cost estimates for proposed developments at the recreation areas. This task also identifies design codes and building standards.

The conceptual infrastructure plans are based on the facilities identified in the conceptual site plans. The building designs use the site layout and square footages identified in the site plans and add architectural details and layouts. These details are intended as sample designs for a concessionaire. The final architectural designs are to be determined by the concessionaires, with Reclamation approval.

The infrastructure addressed in this report includes buildings, potable water, sewer, electricity, access and other surfaced areas. Potable water and wastewater services and infrastructure are identified, including necessary treatment processes. For electricity designs, this report identifies electrical service, including transformers, panels, and meters at each recreation area. This report also provides design details on access, including vehicle circulation, pedestrian paths, parking, and boat launches.

## **1.3 Relationship to Other Project Tasks**

The Conceptual Infrastructure Design is a single task in the Lake Berryessa Concession Concepts project. It is closely related to the other project tasks, both by incorporating results and providing inputs. The Lake Berryessa Concession Concepts planning process is an iterative one in order to achieve the goals of the Visitors Service Plan (VSP) Record of Decision (ROD) and identify financially feasible conceptual site plans and infrastructure plans to include in the prospectus for concessionaires to bid on the recreation area developments.

### **1.3.1 Market Assessment**

The Market Assessment provided the starting point for the site plan design. Development of the site plans used the listed recreation services and facilities in the Market Assessment as the basis of the site planning and design process for each of the five concession areas. The Market Assessment recommend the quantities of services and facilities to meet future unmet demand at Lake Berryessa; the site designs attempt to locate, arrange, layout, and fit the listed services and facilities into the landscape of each concessionaire property.

### **1.3.2 Conceptual Site Plans**

Chapters 2 and 4 of the Conceptual Site Plans report define the proposed recreation facilities at Lake Berryessa and identify the number and type of

facilities and services at each of the five recreation areas. Specifically, Tables 4-1 and 4-2 of the Conceptual Site Plans report lists the quantities of the required and authorized facilities and services at each recreation area. Required services are facilities, services and activities that the concessionaire will be required to offer; these services are not optional and must be provided. Authorized services are facilities, services and activities that the concessionaire can choose to offer. Any services not included in either category is not allowed without a contract amendment or written authorization from Reclamation.

This task provides civil and sample architectural design details on buildings, structures, and utilities at the recreation areas. The infrastructure designs are based on the facilities and services proposed in the conceptual site plans. The site plan quantities are used to select and size water and wastewater infrastructure.

### **1.3.3 Financial Feasibility Evaluation**

The financial feasibility evaluation estimates capital costs, operating expenses, and revenues to determine the financial viability of the proposed recreation areas. The infrastructure designs provide the information needed to estimate construction costs of the recreation developments. These costs are inputs into the financial feasibility evaluation.

## **1.4 Reclamation Design Guidance**

Several Reclamation documents provide guidance on the infrastructure design of recreation areas. The conceptual site plans also follow this design guidance relative to siting and layout of facilities.

### **1.4.1 Visitor Services Plan Record of Decision**

Reclamation issued the Future Recreation Use and Operations of Lake Berryessa, referred to as the VSP ROD, in June 2006. The VSP ROD amends the 1993 Reservoir Area Management Plan (RAMP). The VSP ROD addresses only certain concessions and recreation management activities at Lake Berryessa with all other items, features, activities, and operations approved in the 1993 RAMP ROD remaining unchanged and in effect. Together, they provide the comprehensive recreation and resource management guidance for Reclamation at Lake Berryessa. Reclamation's stated goal at Lake Berryessa is "to provide outdoor recreation facilities and services for the visiting public at Lake Berryessa which will accommodate a variety of aquatic-related recreation experience opportunities, to the extent and quality and in such combination that will protect the aesthetic and recreational values and assure optimum short-term recreational use and enjoyment and social benefit."

Relative to facilities, the VSP ROD limits future development of the recreation areas to facilities that support short-term, traditional, non-exclusive and diverse

recreation opportunities at the lake. All facilities must be constructed or installed, operated and maintained by the concession contractors.

#### **1.4.2 Reclamation Recreation Facility Design Guidelines**

Reclamation's Recreation Facility Design Guidelines (April 2013) provide a checklist of initial design data and examples of recreation facility design details. The Conceptual Site Plans referenced these guidelines in siting of facilities and services. For the conceptual infrastructure designs, these guidelines were used to design buildings and structures, and utilities, including water, sewer, and electricity. The appendices of the Recreation Facility Design Guidelines include example designs for an entrance station, camping and picnicking facilities, trailer dump stations, comfort station buildings, boating facilities, fishing facilities, recreation area roads and utilities, and foot trail and beach access. It is anticipated that the Recreation Facility Design Guidelines will continue to be a resource for concessionaires in the planning and budgeting of recreation infrastructure.

#### **1.4.3 Reclamation Concession Management**

The Concession Management Guidelines, Subchapter 1-1, page 1-5 states the following relative to construction:

“All construction should harmoniously integrate with the environment. Facilities that are historic or cultural resources should be managed to maintain their intrinsic qualities through sustained conservation. Architectural style, design elements, and construction materials should reflect the area and its history.

Plans and specifications for any and all construction and landscaping development on Government-owned lands assigned to the concessionaire must be approved, in writing, by Reclamation before the work may begin. Plans must be prepared in accordance with Reclamation standards.

All concession-related construction activities must conform to nationally applicable codes, such as the International Building Code and the National Fire Protection Association codes, including the International Fire Code, in the latest editions. Regional and local codes are to be adhered to when they are more stringent than national codes or address unique issues. Even where area jurisdiction requires adherence to local codes, concession-related construction will conform to any higher standards in national codes. The seismic safety standards are to be applied to new buildings designed and constructed within Reclamation.”

Reclamation Directives and Standards, LND 04-01 further states that “All the concessionaires' facilities will be harmonious in form, line, color, and texture with the surrounding landscape.”

These guidelines and standards were used in the development of the architectural themes of the buildings and required utility services.

#### **1.4.4 Reclamation Sustainable Buildings Implementation Plan**

Executive Order 13423, signed on January 24, 2007, and Executive Order 13514, signed on October 5, 2009, require Federal agencies to design, construct, and operate Federal buildings in a more sustainable manner to reduce environmental and economic impacts. The Guiding Principles to achieve the executive orders are:

1. Employment of integrated design principles
2. Optimization of energy efficiency and use of renewable energy
3. Protection and conservation of water
4. Enhancement of indoor environmental quality
5. Reduction of environmental impacts of materials

Reclamation has developed a Guiding Principles Checklist for New Construction and a Guiding Principles Checklist of Existing Buildings to convey detailed information on each of the Guiding Principles and act as a tool for assessing and documenting the requirements.

### **1.5 Report Organization**

This report is organized into the following chapters:

- Chapter 1 Introduction
- Chapter 2 Facilities Infrastructure Design
- Chapter 3 Water and Wastewater Infrastructure Design
- Chapter 4 Electrical Infrastructure Design
- Appendix A Conceptual Infrastructure Design Drawings

## Chapter 2

# Facilities Infrastructure Design

This chapter defines the design concepts for buildings and structures to be provided at Lake Berryessa. The buildings and structures provide recreation services as recommended by the Market Assessment and further developed in the Conceptual Site Plans. This chapter also provides further detail on access, including roads, pedestrian paths, parking, and boat launches.

### 2.1 Design Criteria and Assumptions

Facilities shall meet the International Building Code, the International Plumbing Code, National Electric Code, all applicable fire codes and all other design codes applicable to the development performed by the contractor. Facilities shall be compliant with the National Fire Protection Association (NFPA) Life Safety Code, and all accessibility requirements (Architectural Barriers Act Accessibility Standards, 2010 Americans with Disabilities Act (ADA) standards for Accessible Design and the Accessibility Guidelines for Outdoor Developed Areas). All applicable codes and standards should be those versions approved by Reclamation at the time of design.

The VSP ROD includes the following design requirements relative to location of facilities.

- a. From elevation 440' to elevation 455' MSL. Reserved for day-use facilities (marina facilities, swimming areas, picnic sites) and the following non-permanent overnight use facilities: park models approved for short-term occupancy, RV and travel trailer sites, campgrounds, and tent camping. Picnic tables, BBQ grills, restrooms, and other supporting infrastructure for these facilities must be flood-proofed. Flood-proofing for these structures and facilities includes, but is not limited to, sealed openings, removable utilities, flotation devices, and anchoring. Park models must be removed during the off-season or in anticipation of high-water events.

Retail stores and food and beverage facilities may be located at elevations 440'-455' MSL but only where certified by Reclamation as flood-proof in accordance with reservoir operation requirements, health and safety codes, and other requirements. Flood-proofing for these facilities includes, but is not limited to, stilts, lifts, floating barges, or other features that safely elevate the structure above elevation 455' MSL.

- b. From elevation 455' MSL to the Federal Property Line. Hotels, motels, conference facilities, cabins, cottages, and lodges must be located above the reservoir surcharge area (455' MSL and above). This is consistent with project operational requirements for flood control, water supply, and water quality, and promotes compliance with health and safety code requirements. In addition, the following overnight use facilities and supporting infrastructure may be located at or above elevation 455' MSL: park models approved for short-term occupancy, RV and travel trailer sites, campgrounds, tent camping, and picnic sites.
- c. From elevation 455' MSL plus 100 Linear Foot (LF) Buffer to the Federal Property Line. All cabins, park models, or cottages approved by Reclamation for annual occupancy – along with aeration ponds and sewage system infrastructure other than pipelines, lift stations, and other appurtenant devices – must be located above elevation 455' MSL plus 100 LF buffer. All other facilities identified in paragraphs a. and b. may also be located above this level. The 100 LF buffer preserves space at each concession area for short-term occupancy facilities consistent with the VSP ROD.

The VSP ROD also includes the following environmental commitments that relate to construction and development.

- Reclamation shall require that Best Management Practices be included in all construction activities to minimize potential soil erosion during construction. Measures to separate construction areas from water sources and to protect wetlands shall be implemented, soils shall be stockpiled and covered in suitable locations to prevent erosion, and disturbed areas shall be covered as necessary for protection from wind and rain.
- Wherever possible, new development shall be sited within existing developed areas. Any areas disturbed by construction activities shall be rehabilitated as appropriate.
- Future proposals for new roads and other transportation facilities shall take advantage of existing corridors in order to minimize potential impacts. Wherever feasible, the re-planting of vegetation and re-use of landscape materials disturbed during construction will be used.
- Temporary impacts to fish and wildlife resources from development activities shall be mitigated by rehabilitating disturbed habitat and by employing construction techniques to limit the amount of dust and noise.
- The redevelopment of concession areas shall include provisions to ensure facilities are sited to minimize visual intrusions from the lake,



with new structure and supporting utilities designed to blend with the surrounding environment.

- New units or structures constructed or installed, operated, and maintained by contractors shall conform with thematic requirements that reflect a natural condition.

## 2.2 Architectural Considerations

An important element recommended in the Market Assessment is to provide recreational facilities that enhance the recreation experience. The report states that the construction of high quality recreation facilities and services will encourage return visits, increase the financial viability of commercial operations, and maintain and/or improve visitor satisfaction and user expectations. Buildings and structures can contribute to the recreation experience by creating thematic architectural design requirements, including building forms and materials.

A brief examination of Napa and Sonoma Valley architecture reveals three architectural themes or trends including historical styles, eclectic or imported styles and rural vernacular styles.

*Historical Style.* Historically, mission style architecture is strong in northern California. The Sonoma Historical Plaza was designed by General Mariano Vallejo during the Mexican Era. Mission de Solano, circa 1823, is the last of the 21 California Missions.

*Imported Style.* The Mediterranean micro climate in the region provides exceptional growing conditions for an array of grape varieties, olive oil and lavender. Vintners have imported an eclectic blend of architectural styles from wine regions in Western Europe including Tuscan, Italianate, Bordeaux and Greco-Roman styles. More ubiquitous to the region, however, are the agricultural buildings including barns, farmhouses and storage silos.

*Vernacular Style.* This vernacular architecture is recognizable for its vocabulary of rural details and straightforward, low-tech materials such as wood beams, wooden plank siding, and gable roofs made of basic materials such as standing seam metal or plain corrugated steel.

The architectural plans and elevations provided in this report illustrate a modified version of the preferred vernacular architectural character or theme and graphically depict the recommended building types, general areas, heights and overall scale and construction materials. The drawings, together with the architectural elements described below, provide a general guide and sample to the character and design for buildings within the Lake Berryessa recreation areas described in this report. Final design and construction documentation

shall meet the building code requirements and will be the responsibility of the concessionaire.

Design elements can include:

- Simple gable roof forms with metal roofs
- Decorative gable trusses at covered building entries with round columns at building porches
- Open gable building end walls at comfort stations to provide air circulation
- Exposed rafter tails to enhance the roof edge and roof overhang
- Building walls with wood grain textures and horizontal lines
- Outdoor decks suspended above the sloping terrain on round piers.

## **2.3 Building Types**

The following description of building types suggests that the architectural theme, including building forms, materials and details, should be similar across all recreation areas. This section describes buildings for both required and authorized services. Required services are facilities, services and activities that the concessionaire will be required to offer; these services are not optional and must be provided. Authorized services are facilities, services and activities that the concessionaire can choose to offer. All buildings and facilities associated with this project and described herein shall be accessible.

### **2.3.1 Retail Uses**

The retail store will provide refreshments, drinks, ice, limited sundries such as caps, t-shirts, toiletries, camping and boating supplies, and fishing bait and tackle for sale to recreation visitors. The retail store design will include men and women toilets as well as supply storage and office with convenient access to parking and delivery. Retail should provide all of the support, storage and delivery functions on the vehicle parking and delivery side of the building with the public retail and boat rental functions oriented toward the lake and the lake views.

Steele Canyon and Putah Canyon have required retail services. The retail building at Steele Canyon, which is combined with the marina building, has been designed as light frame structures with gable roofs and open outdoor decks. The retail use will be classified according to both the International Building Code and the California Building Code as Mercantile Use, Group M, as further described in Table 2.1.

The retail at Putah Canyon is part of the floating marina building. There are also authorized retail services at Monticello Shores, Berryessa Point, and Spanish Flat.

### **2.3.2 Restaurant Uses**

Steele Canyon and Putah Canyon have required restaurant services. There are authorized restaurants at Monticello Shores, Berryessa Point, and Spanish Flat. Restaurants may offer varying levels of food service, such as sit-down/full service or casual/take-out service. Full-service restaurant sizes may vary and serve up to 40 customers. Casual-service may include a sandwich counter, small café, or grill. At Putah Canyon, the required restaurant is located in the floating marina and is a take-out counter with sandwiches, salads or other café items. The restaurant at Steele Canyon is a separate building from the marina and assumes about 30 customers seated inside at approximately 2,600 SF. There is a patio deck that could accommodate additional seating. The restaurant building is located within walking distance of the marina. Restaurant facilities should be designed with the delivery, storage and kitchen functions on the vehicle parking and delivery side of the building with the dining and outdoor deck on the lake side of the building.

The Steele Canyon restaurant, depicted in figures in Appendix A, is designed as light frame structures with gable roofs and open outdoor decks. The International Building Code and the California Building Code classifies restaurant occupancies as Assembly Uses, Group A-2. Specifically, assembly uses intended for food and drink consumption including Restaurants are further summarized in Table 2.1.

### **2.3.3 Employee Housing**

Multiple park models will be used to house seasonal or permanent employees. Steele Canyon Recreational Area will provide 10 park models. Employee housing is an authorized service at Putah Canyon with 6 park models.

### **2.3.4 Boat Storage Facility**

The dry stack boat storage facility at Steele Canyon is planned as a semi-outdoor high-rack storage facility for 96 boats. The three-sided structure is walled on both the rear and sides of the facility leaving the front open for forklift access and easy boat loading and retrieval. Full closure of the building is an authorized service. Dry stack storage reduces the need to increase water surface area of the marina and allows smaller boats to be stored on land leaving the on-water berths available for larger vessels. The site layout and the compact building footprint decreases the amount of cut needed for construction.

The proposed structure provides a single row of 24 boat parking bays, approximately 10 ft wide by 30 ft deep, stacked in four levels for a total of 96 boat storage spaces. The overall building footprint is approximately 30 ft wide by 240 ft long, or approximately 7,200 SF. Boat storage facilities, whether

indoor or outdoor will include a nearby Shop/Tow Service Building and service yard for maintenance, repair, and storage preparation.

The building design (Appendix A) anticipates a pre-engineered, turn-key type building product, common in the boat storage industry. The boat storage use is classified as a moderate hazard storage use, Group S-1 occupancy. Pre-engineered metal buildings, however, may not be consistent with the architectural design elements or the local and regional standards. Reclamation should review all proposed pre-engineered metal buildings to assure the integration of design standards and themes.

The required dry boat storage at Putah Canyon is a paved lot and does not include a building. The boats will be parked and stored on a trailer in the lot. There is no required or authorized dry boat storage at Monticello Shores, Berryessa Point, and Spanish Flat.

### **2.3.5 Multiuse Special Events Center (Authorized Facility)**

The multiuse special events center is an authorized service at Steel Canyon, intended for special events, groups, conferences, and weddings. The multiuse center includes reception, kitchen, restrooms, storage room and two small conference rooms and is planned for a total occupancy of approximately 100 people. The multiuse center can include an adjacent open outdoor deck oriented toward the lake views. The structure has separate the conference rooms from the assembly hall to provide flexibility for scheduling events and the outdoor deck will provide an added amenity for groups and family gatherings. The building is approximately 3,000 SF and is classified according to building codes as an Assembly Use, Group A-3, more specifically described as assembly uses intended for worship, recreation or amusement including Community Halls.

### **2.3.6 Camping, Lodging and Support Facilities**

Tent sites, standard sites, and recreational vehicle (RV) sites require minimal site construction and site furniture. Furniture includes a fire pit and picnic table. Parking for tent sites is in a nearby lot either adjacent to or a short walk to the tent site.

Other lodging types are anticipated to be pre-manufactured park models, yurts, cabins, rustic cabins, and tent cabins. Utilities and furniture vary at the lodging units and are described below. Lodging units each contain one parking space. The proposed number of required facilities and services for each recreational site are further described in the Conceptual Site Plan Report, Table 4.2. Buildings must comply with all accessibility guidelines.

#### ***Camping***

- Tent-only site 30 ft x 30 ft. Includes a picnic table and fire pit, some sites include an elevated level tent pad depending on slope. Parking is nearby.

- Boat-in or Hike-in site 30 ft x 30 ft. Same as tent-only site but without parking. Authorized only.
- RV single unit site 1,800 SF to 2,200 SF. Includes a picnic table and fire pit. Water, sewer, electric hookups.
- RV double unit site 2,800 SF to 3,200 SF. Includes a picnic table and fire pit. Water, sewer, electric hookups.
- Standard site (trailer/tent) 30 ft x 100 ft. Includes a picnic table and fire pit. With or without water, sewer, electric hookups. Can be pull-through or back in.
- Floating site Includes accessible toilet, BBQ grill, food locker, covered living, upper-deck sleeping (with room for tents). Authorized only.

### ***Lodging***

- Full-Service Cabins Permanent on-site construction. Sleep up to 4 adults. Includes bed, bathroom, stove, sinks, living area with table and pull-out couch. Water, sewer and electric inside. Picnic table and fire pit outside. Parking space for one vehicle, additional parking space is authorized.
- Park models Pre-manufactured recreation vehicle limited to 400 SF. Sleep up to 4 adults. Includes bed, bathroom, stove, sinks, living area with table and pull-out couch. Water, sewer and electric inside. Picnic table and fire pit outside. Parking space for one vehicle, additional parking space is authorized.
- Yurt 2,500 SF site. Round, semi-transparent, tent-like structure. Sleep up to 4 adults. Includes bed or bunk beds, living area with table and pull-out couch. Picnic table and fire pit outside. No required water, sewer, or electric hookups, though hookups are authorized. Parking space

for one vehicle, additional parking space is authorized.

- Rustic Cabins

2,500 SF site. Permanent on-site construction. Sleep up to 4 adults. Includes cots, bunk beds, storage shelf, and table. No required water, sewer, or electric hookups, though hookups are authorized. Picnic table and fire pit outside. Parking space for one vehicle, additional parking space is authorized.

- Tent Cabins

2,500 SF site. Wood and canvas. Includes cots, bunk beds, and benches. Sleep up to 4 adults. No water, sewer, or electric hookups. Picnic table and fire pit outside. Parking space for one vehicle, additional parking space is authorized.

#### ***Facilities/Infrastructure***

- Entry station

52 SF. Vehicle entry, registration, and fee collection.

- Vault Toilet

125-250 SF. Self-contained toilet building. Contains two toilet rooms. Entrance station vault toilet contains one toilet room, intended for entry staff use.

- Comfort station #1

700 SF, toilets only.

- Comfort station #2

925 SF, includes toilets, family room and dishwashing sink located outside.

- Comfort station #3

925 SF, includes toilets, family room, showers, and dishwashing sink located outside.

- Comfort station #4

1,100 SF, toilets, family room, showers, laundry and dishwashing sink located outside.

- Fish cleaning station

Cutting table, sink with grinder and waste receptacle.

- Camp host

Full-Service RV site provided.

## 2.4 Architectural Criteria

Three construction types have been developed for the Lake Berryessa recreation areas in response to three different siting conditions: (1) Concrete block masonry structures on grade, (2) pier or pole structures on sloping grades, and (3) pre-manufactured structures that may be sited in a variety of situations or locations for service or lodging accommodations; however, pre-engineered structures require approval of Reclamation as building forms, materials and styles are limited.

Comfort stations, fish cleaning stations, and entry structures that are sited on grade in close proximity to parking areas, camping, and lodging, where continuous footings and foundations are practical, should be constructed of concrete masonry units (CMU) for durability, ease of maintenance and building longevity. Concrete block is also a modular material that can more easily be transported and erected in the remote areas.

Marina building and marina related facilities, such as restaurants or retail facilities that provide lake oriented amenities and services to the recreation experience are proposed as framed structures on grade. These facilities will benefit from the extensive use of open outdoor decks and public common areas that provide exterior connections between facilities and maximize access to scenic views. All major facilities are planned above the 455 ft elevation, unless a floating marina is proposed. Putah Canyon and Spanish Flat marinas are proposed to be floating and connected to the dock and boat slips.

Pre-manufactured structures such as semi-permanent park models provide the greatest flexibility for concessionaires. While the units require a relatively flat site, the delivery, mobilization and set-up require minimum site disturbance. Rustic cabins, cabins, yurts and tent cabins may be site-built or pre-manufactured units.

### 2.4.1 Floors

On-grade construction floors will be concrete slab-on-grade with non-slip broom, stamp or float finish, or other non-slip finishes as approved.

Above-grade construction floors will be constructed on pressure treated wood beams and floor joists with synthetic or composite wood decks. If redwood, cedar or cypress decks are proposed or used in special or limited areas, those natural woods must be obtained from certified wood suppliers.

### 2.4.2 Exterior Walls

Comfort stations will be CMU with integral colors that do not require painting or other maintenance. Masonry sealers and anti-graffiti coatings will be provided.

Recreation facility buildings, such as marina, restaurant, or multi-use center will be wood framed with plywood sheathing, vapor barriers and wide-plank, cement board siding with horizontal ship-lap or tongue and groove profiles.

### **2.4.3 Exterior Doors and Windows**

All exterior doors will be hollow metal with matching hollow metal frames. Aluminum storefront entrance will be provided at the marina, restaurant and retail stores. All exterior windows shall be clear anodized aluminum windows with operable sash. Security screens should be provided where appropriate. Glazing will be dual-pane, low-E, or tinted as necessary. Doors, frames and window frames will be factory finished with accent colors that require no field painting. All windows and doors should be installed to the inside face of exterior walls to create a recess and shadow-line at exterior openings.

### **2.4.4 Roofs**

Roofs will be standing-seam metal roofs with slate grey or galvalume factory finish or rustic corrugated steel roof in gable roof configurations with ridge caps and 6 in 12 roof pitches to emphasize the gable roof form. More decorative roof profile may be provided by adding a continuous monitor or cupola at the ridge and exposed ridge beams, rafter tails and decorative eave framing for marina retail or restaurant uses.

Building roof structures will be constructed with pre-fabricated roof trusses and should include top-chord extensions or “rafter tails” to provide exposed or decorative framing for roof overhangs.

### **2.4.5 Interior walls**

Comfort stations, vault toilets, fish cleaning stations, and entry stations will simply be the exposed interior side of the concrete block construction materials which have a durable surface that can be easily maintained with a portable hotsy<sup>®</sup> or high-pressure wash.

The interior walls of recreation facilities such as marinas and restaurants will be a combination of gypsum wall board and paint, horizontal wood siding for rustic themes and ceramic tile for kitchen wall surfaces and toilet rooms.

Table 2-1 summarizes the International Building Code for the required and authorized facilities.



**Table 2-1. International Building Code Summary**

Facility	Occupancy Group	Construction Type	Allowable Height and Area	Actual Height and Area
<b>Marina</b>				
Putah Canyon Floating Marina Building Includes Retail and Take-out Restaurant.	Mercantile Group M	Type V-A	Three Stories 14,000 SF	One Story 1,200 SF
Steel Canyon Marina Building. Includes Retail.	Mercantile Group M	Type V-A	Three Stories 14,000 SF	One Story 3,150 SF
<b>Retail Uses</b>				
Putah Canyon Retail (combined in Floating Marina Building)	Mercantile Group M	Type V-A	Three Stories 14,000 SF	One Story
Steele Canyon Retail (combined in Marina Building)	Mercantile Group M	Type V-A	Three Stories 14,000 SF	One Story
<b>Restaurant Uses</b>				
Putah Canyon Restaurant (combined with Floating Marina)	Assembly Group A-2	Type V-A	Two Stories 11,500 SF	One Story
Steele Canyon Restaurant (separate building)	Assembly Group A-2	Type V-A	Two Stories 11,500 SF	One Story 2,600 SF
<b>Multi-Use Center</b>				
Steele Canyon Multi-Use Center (authorized service)	Assembly Group A-3	Type V-A	Two Stories 11,500 SF	One Story 3,000 SF
<b>Employee Housing</b>				
Putah Canyon (Park Models) (authorized service)	N/A	N/A	N/A	N/A
Steele Canyon (Park Models)	N/A	N/A	N/A	N/A
<b>Boat Storage Facilities</b>				
Steele Canyon Boat Storage	Moderate Hazard Storage S-1	II-B Non-Combustible Unprotected	2 Stories 17,500 SF (Allowable height and area may be increased with automatic fire sprinkler system)	Four Stories 7,200 SF

## **2.5 Access, Parking, and Boat Launches**

Recreation areas at Lake Berryessa are accessible by both vehicles and pedestrians. The many different circulation elements including vehicle access drives, parking areas, pedestrian walkways and launch ramps have an equal variety of surface types and surfaces. The circulation element should incorporate accessibility and safety into the design and provide the connections within the recreation areas that enhance the recreation experience. The surfacing types will best suit the intended uses. In order to reduce site grading and environmental disturbance, access in and around the recreation sites has been designed by incorporating physical characteristics of the existing vehicle access and circulation system, and are located near or within existing paved areas and boundaries.

Vehicle access drive widths, turning radii, and ends to vehicle access driveways have been designed in accordance with the SRA Fire Safe Regulations and the Recommended Change to SRA Fire Safe Regulations, California Code of Regulations, Title 24, 1270 Fire Safe Regulations updated 2012.

Existing vehicle access drives and parking areas have met or exceeded their useful life with some original pavements up to 40 years old. Heavy wear and lack of maintenance in recent years have left most of the paved infrastructure in derelict condition and replacement or rehabilitation is needed.

### **2.5.1 Surfacing for Roadways and Parking Areas**

Where feasible, in-place recycling is recommended for pavement rehabilitation. This strategy removes, recompiles and places existing pavement material on-site in a single operation. In-place recycling reduces off-site hauling and disposal, minimizes demand for new material, and is a cost-effective technique where there are significant surface or base repair needs. In addition, recycling reduces construction delays, reduces the environment effects, and reduces green-house gas associated with mining and trucking new material.

Typical pavement cross-section of 3" asphalt on 4" aggregate base has been assumed for the purpose of cost estimating, however, pavement design may vary based on existing conditions. Longevity of surface materials on access drives and parking is directly related to sub-surface conditions.

There are three recycling methods used to correct pavement deficiencies such as rutting, cracking, oxidation, brittleness, irregular shrinkage and exposed aggregates, including (1) cold in-place recycling, (2) hot in-place recycling, and (3) full-depth reclamation.

Cold in-place recycling removes the existing pavement by cold planing to a depth of 3 to 4 inches. The material is pulverized, sized, and mixed with an asphalt emulsion or a recycling agent. The material is then placed and

compacted. An additional layer, such as chip seal, or hot-mix asphalt, is optional.

Hot in-place recycling softens the existing pavement by heating and the pavement is then scarified or hot milled to a depth of  $\frac{3}{4}$  to  $1\frac{1}{2}$  inches and mixed. New hot mix material and/or a recycling agent is added in a single process. A new wearing course may also be added with an additional pass after compaction.

Full-depth restoration uses all of the existing asphalt pavement and a portion of the underlying material to produce a stabilized base course. The materials are crushed and additives are introduced. The combined materials are then shaped and compacted and a wearing surface is applied.

While paved parking areas may also take advantage of in-place recycling, it is recommended that sustainable design strategies such as the use of porous pavement be considered, especially where stormwater runoff is a concern. Porous or natural surfaces may be a better solution for larger areas in order to reduce run-off and non-point source pollution into the lake.

### **2.5.2 Pedestrian Walkways**

The design of recreation areas should make clear separation of vehicular and pedestrian circulation while providing safety and accessibility to all recreation opportunities. The use of contrasting natural color surface materials can contribute to creating a cohesive element within the recreation area complementary to the landscape setting. The use of porous and natural surface materials will contribute to stormwater management and reduce run-off into the lake.

The use of colored concrete is recommended in close proximity to vehicle parking areas and access to buildings and recreation facilities. Concrete colors should be developed to match surrounding soils and compliment the native landscape. Concrete should have a cross-directional broom finish to provide a slip-resistant surface in and around recreation facilities, parking areas and comfort stations.

Stabilized soils are recommended for pedestrian trails in close proximity to recreation facilities. The material is made from native soils mixed with natural or synthetic emulsions or binders and compacted to form a firm, permanent resilient surface that has the appearance of native landscape soils that have been raked clean.

Finely graded aggregates are useful for pedestrian paths, multipurpose paths, and high-use areas where a natural appearance is desired. The surface is a blend of  $\frac{3}{8}$  inch minus, well-graded aggregate that compacts to a reasonably hard surface ideal for relatively flat areas, but not recommended for steeper areas or

grades. A local source of aggregate should be found to provide a coloration similar to the native terrain.

### **2.5.3 Launch Ramps**

Design and construction of boat launch ramps involves unique design considerations including soils, site conditions, water level fluctuations and traffic capacities. Boat ramps already exist at several recreation areas, and where ramps presently exist, the land use will remain as a boat launching facility.

Individual evaluation of each existing launch ramp will be necessary in formulating the approach for ramp rehabilitation or reconstruction. The extent of water side erosion and undercutting, for example, will determine the extent of reconstruction. Existing launch ramps at Putah Canyon and Steel Canyon Recreation areas may be recycled in-place similar to the solution for asphalt paving rehabilitation, but will need to be evaluated on a case by case basis. The site plans propose launch ramps at Spanish Flat and Berryessa Point in the existing locations of previous launch ramps. These ramps also need to be assessed if they can be rehabilitated or need to be replaced. At this time, the cost estimates assume ramps can be rehabilitated. A new boat launch is proposed for Monticello Shores.

Many ramps are constructed of cast-in-place concrete, pre-cast concrete planks or a combination of the two. Launch ramps may be constructed entirely of cast-in-place concrete extending into and below the water level with the use of coffer dams, or by directly placing concrete in underwater forms and using underwater consolidation. When underwater construction is not practical, there are several options for boat ramps, such as articulating cabled, or interlocking precast concrete block systems, or pre-cast concrete plank systems, both of which may be used for the entire length of the ramp. Use of pre-cast concrete planks is assumed to be used for rehabilitation of the boat launches at the recreation areas.

The surface of the ramp should be textured to allow traction for motor vehicles towing trailers, but should not be so coarse as to cause distress to people walking on the ramp. Ramps are often designed with finer textures between the lanes for pedestrians and coarser textures in the launch lanes for towing traction.

Protecting the edges of the ramp from erosion is essential. The edges of the ramp should have extra support, and if a slab, should be thickened, or turned-down up to three feet in depth, into the sub-base. In addition to the thickened edge of the slab, edge protection consisting of rock or boulder rip-rap should be placed over a double layer of geotextile and placed to slope away from the launch ramp to create an apron of protection approximately 4 ft in width both sides of the ramp. Boulders may vary in size from 12 inch to 30 inch rip-rap depending on extent of exposure.

## 2.5.4 Access Drive Quantities

Table 2-2 summarizes the estimated quantities for access, parking, and launch ramps for each recreation area.

**Table 2-2. Approximate Pavement Infrastructure Quantities**

<b>Recreation Area</b>	<b>24' Wide Public Access Drives</b>	<b>14' Wide Service Access Drives</b>	<b>Parking Areas</b>	<b>Launch Ramps</b>
Putah Canyon	7,600 LF	3,000 LF	170,000 SF	38,000 SF
Monticello Shores	8,300 LF	6,900 LF	111,600 SF	12,000 SF
Berryessa Point	4,200 LF	1,800 LF	4,000 SF	4,200 SF
Spanish Flat	6,800 LF	4,800 LF	100,200 SF	8,000 SF
Steele Canyon	7,400 LF	3,500 LF	221,300 SF	30,000 SF

## 2.5.5 Screening and Landscaping

Landscape planting and vegetative screening are key elements of the recreation area design and can serve to visually and physically integrate the built facilities into the surrounding landscape, unify recreation areas, emphasize lake views, break up the scale and mass of structures and hard surfaces and create a comfortable campus environment.

Landscape planting and vegetative screening techniques should:

- Soften hardscapes such as parking areas, buildings and structures,
- Encourage safe and pleasant use of walkways and paths,
- Enhance the microclimates of areas by providing shade, wind and noise buffers,
- Incorporate existing and provide new plantings that are native to promote the health of the surrounding ecosystem and reduce maintenance,
- Screen campgrounds from vehicle access areas to create secluded feeling and enhance a peaceful experience

Appear as naturally occurring extensions of existing landscape features by using native plants, rocks and logs in informal and natural groupings, that also define access ways, pedestrian routes, approaches to buildings, stormwater control areas, etc.

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# Chapter 3

## Water and Wastewater Infrastructure Design

This chapter presents a summary of the design criteria and a description of the preliminary design of both the potable water and wastewater facilities at the five recreation areas.

### 3.1 Design Criteria and Assumptions

#### 3.1.1 Potable Water System

Preliminary design of the potable water facilities for each of the five recreation areas focused on determining anticipated system demands, potable water supplies, storage requirements, and the distribution systems needed to deliver max day water demands and fire flows. Because the designs of the campsites are still in preliminary stages, these design criteria, and therefore the sizing and final design of the facilities, are subject to change as more site specific information is obtained.

##### **System Demands**

Maximum daily potable water demands for each site were calculated by multiplying the number of each type of facility (tent site, RV site, cabin, etc.) by the maximum daily water demand for that type of facility and then totaling the water demands for all facilities. This assumes that all facilities are fully occupied. This condition is expected to happen at least once each year. These assumptions are expected to be further refined in future design.

The maximum daily water demands for each type of facility are as follows (15a North Carolina Administrative Code 02T.0114, University of Minnesota 2011, US Department of Agriculture Forest Service 2007, and Erie & Van Sande Civil Engineers, Inc. 2011<sup>1</sup>):

- Each rustic cabin, yurt, tent cabin, tent only site, or standard campsite sites with partial hookups for utilities will require 75 gallons per day (gpd).
- Each RV site or standard campsite with full hookups for utilities (water, sewer, and electric) will require 100 gpd.

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<sup>1</sup> Erie & Van Sande. 2011. *Lupine Shores & Berryessa Highlands Wastewater & Domestic Water Analysis*. April 6, 2011.

United State Department of Agriculture Forest Service (USFS). *Engineering Tech Tips: Water Use in Forest Service Recreation Areas: Guidelines for Water System Designers*. September 2007.

Regents of the University of Minnesota (University of Minnesota). 2011. *Section 5: Wastewater Sources and Flows*.

- Each park model or cabin will use 200 gpd.
- The camp host site will use 200 gpd.
- Overnight group use sites for up to 50 people are assumed to have a water demand of 1,000 gpd, while those overnight sites for up to 10 people or less are assumed to require 200 gpd.
- Individual day use sites are assumed to have a water demand of 20 gpd per site (or 10 gpd per user, with two users per site).
- The water demand for day use group sites is assumed to be 10 gpd per user, equating to 200 gpd per site for group day use sites up to 20 people.
- For sit-down restaurants, water demand is estimated to be approximately 40 gpd per seat. The restaurants are assumed to have 30 seats in the restaurant, resulting in a total water demand of 1,200 gpd.
- Laundry facility use is assumed to be approximately 500 gpd per machine. Each laundry facility is assumed to have two machines, resulting in a total water demand of 1,000 gpd.
- Potable water for the marina is assumed to require 20 gpd per slip for day use and 30 gpd per slip for overnight use.
- Potable water demand for houseboat slips is assumed to be 75 gpd per slip.
- Housing for both permanent and seasonal employees is assumed to have a water demand of 200 gpd per park model.

Maximum day potable water demands and corresponding flow rates assume that all facilities are in use at the same time. This condition is expected to happen at least once each year.

In addition to delivering potable water, the water supply system must also provide any necessary water for fire protection. Napa County's Code of Ordinances (Chapter 15.32 – Fire Code), which has adopted the use of the 2013 Edition of the California Fire Code (subject to modifications as described in the County's Code), summarizes the minimum flow, duration, and storage requirements for fire protection. These requirements are based on the square footage of the largest structure on site. Table B105.2, "*Minimum Required Fire Flow, Flow Duration, and Storage Volume for Light Fire Hazard Occupancies including but not limited to Residential Occupancies, Churches, Colleges, Dormitories, Hospitals, Institutions, Museums, Office Buildings and Schools not served by a Public Water Supply,*" summarizes the applicable requirements for



the recreational areas supplied by a groundwater well. The largest structures at these facilities will be the marinas, which will fall under the smallest square footage range in Table B105.2 (shown in Table 3-1); therefore the required fire flow will be 200 gallons per minute (gpm) for 60 minutes with a required fire storage of 6,000 gallons.

**Table 3-1. Minimum Required Fire Flow, Flow Duration, and Storage Volume for Light Fire Hazard Occupancies including but not limited to Residential Occupancies, Churches, Colleges, Dormitories, Hospitals, Institutions, Museums, Office Buildings and Schools not served by a Public Water Supply (Table B105.2 of Chapter 15.32 of Napa County's Code of Ordinances)**

Fire Area (ft <sup>2</sup> ) (Light Fire Hazard)		Occupancy	Fire Flow Duration (Minutes)	Non-Sprinkled Systems		Sprinkled Systems	
Construction Type: IA, II A, III-A	Construction Type: 1 B II-B, III-B, IV-HT, V-A			Fire Flow (gpm)	Fire Storage (gallons)	Fire Flow (gpm)	Fire Storage (gallons)
16,800	13,300	12,600	60	200	12,000	200	6,000
25,300	19,970	19,000	60	300	18,000	300	9,000
33,700	26,600	25,300	60	400	24,000	400	12,000
42,100	33,250	31,600	60	500	30,000	500	15,000
50,500	39,920	37,900	60	600	36,000	500	18,000
58,950	46,550	44,200	60	700	42,000	500	21,000
67,400	53,200	50,500	60	800	48,000	500	24,000
75,800	59,850	56,900	60	900	54,000	500	27,000
84,200	66,500	63,200	60	1,000	60,000	500	30,000
105,300	83,100	78,950	60	1,250	75,000	625	37,500
126,300	99,700	94,750	60	1,500	90,000	750	45,000
147,400	116,350	110,500	60	1,750	105,000	875	52,500
168,400	132,950	126,300	60	2,000	120,000	1,000	60,000
189,500	149,600	142,080	60	2,250	135,000	1,125	67,500
210,500	166,200	157,900	60	2,500	150,000	1,250	75,000
231,600	182,800	173,670	60	2,750	165,000	1,375	82,500
252,600+	199,450	12,600	60	3,000	180,000	1,500	90,000
	216,050	19,000	60	3,250	195,000	1,625	97,500
	232,700	25,300	60	3,500	210,000	1,750	105,000
	249,300	31,600	60	3,750	225,000	1,875	112,500
	265,900	37,900	60	4,000	240,000	2,000	120,000
	282,550	44,200	60	4,250	255,000	2,125	127,500
	299,200	50,500	60	4,500	270,000	2,250	135,000

Operational pressures in the pipeline were also considered. The minimum pressure during max day demands was assumed to be 40 pounds per square inch (psi), which is a typical industry standard for minimum distribution system pressure. The minimum pressure, or lowest head conditions, result when system demands and pipe friction losses are high, resulting in the lowest system pressures at points furthest away from the source. The minimum pressure was

calculated using fire flows, 200 gpm, for the further connection point in the distribution pipeline for Putah Canyon, Berryessa Point, and Monticello Shores. If the available pressure anywhere within a campground system, as developed by the assumed storage reservoirs' base elevations, was less than 40 pounds per square inch (psi) during max day demand conditions or less than 20 psi during max day plus fire conditions, a booster pump station was added within the system to increase the pressure in these low-pressure areas. Operational pressures at Spanish Flat and Steele Canyon will be provided by the existing local potable water pipelines, which have been sized for the additional demands required by these new developments. Maximum pressures at any location within the campground systems are not expected to exceed 80 psi.

### ***Supply Well***

Potable water at Putah Canyon, Berryessa Point, and Monticello Shores will be supplied by groundwater wells located at each of these recreation areas. It was assumed that the groundwater well site and pump would be located on the property and controlled and maintained by the concessionaire. In the case that groundwater is unavailable for these sites; a new water intake would need to be constructed to take water directly from Lake Berryessa. Potable water at Spanish Flat and Steele Canyon will be supplied by the existing local potable water pipelines, which have been sized for the additional demands required by these new developments.

Groundwater well sites were designed to fit within a 40 ft by 40 ft fenced off area (see Appendix A, LB-D601INPL). It was assumed that recreation areas receiving groundwater will, at a minimum, be disinfected via chlorination using sodium hypochlorite to be suitable for potable use. However, because the water quality of the groundwater at each site is currently unknown, a portion of each groundwater well site was reserved for the addition of treatment filters, if determined to be necessary. If groundwater is unavailable, additional treatment beyond chlorination will be required to meet regulations.

Each groundwater well site would include a transformer pad, electrical equipment pad, chlorine storage and feed pump area, groundwater pump, well head valves (including check valve), and chlorine injection site. It is assumed the groundwater well valves and piping will be 3 to 4-inch galvanized steel or polyvinyl chloride (PVC) pipe at the wellhead.

Sizing of the groundwater pump takes into account the assumed groundwater yield rate of each of the potential well sites, provided by Reclamation, and the pressure that must be generated by the pump to lift the groundwater from the assumed hydrostatic groundwater level to the maximum water height of the storage tank (including frictional hydraulic losses). Although the well will draw water from lower aquifer units, not impacted by surface water, it was assumed that the hydrostatic level within the well would match the average lake level (an elevation of 425 ft) and that there is no artesian pressure within a lower

confined aquifer. Fifty (50) feet of drawdown within the well was assumed to occur as a result of pumping.

It is assumed that chlorination of the raw well water would use a 12 percent solution of sodium hypochlorite at a dosage of 3.5 parts per million (ppm). A 30 gallon double containment storage tank will house the sodium hypochlorite solution at the groundwater well head. Depending on the site and the seasonal use rate, it is estimated that a chemical storage tank of this volume will hold enough solution to chlorinate the raw water for a range of 10 to 30 days if the groundwater pump were run continuously.

### ***Storage Reservoirs***

For those sites supplied with potable water from groundwater, a storage facility will be required to store the pumped potable water for distribution throughout the concession area. The minimum required storage volume for the reservoirs is determined from the sum total of the necessary operational and fire flow storage. Operational flow was determined, on a per site basis, using the assumed maximum day flows described above. Fire flow storage is based on Table B105.2 of Chapter 15.32 of Napa County's Code of Ordinances (see Table 3-1, above) and requires a minimum water storage volume for fire protection of 6,000 gallons for structures with automatic sprinklers or 12,000 gallons for structures without automatic sprinklers. Larger structures, greater than 3,600 SF, will have automatic sprinklers.

Bolted steel storage tanks were located at the highest accessible elevations at each recreation area to assist in developing pressures throughout the distribution system. The need for easy access to each tank site as well as parking for future operations and maintenance needs was considered in locating and sizing the tank areas.

The preliminary design of the tanks can be found in Appendix A Typical Water Storage Tank. As shown in the figure, each tank will be equipped with two access hatches, one along the side of the tank and one located on the roof of the tank with an access ladder, for ease of maintenance. Each of the tanks will also have a vent on the roof, a 12-inch pipe for overflow, water level gauge, and drain. The 12-inch inlet/outlet pipe will be used to fill the tank from the groundwater well pump and to distribute potable water throughout the recreational area.

### ***Distribution System***

The potable water distribution system will be constructed using various diameter sizes of high-density polyethylene (HDPE) pipe, as required by Reclamation standards. The various pipe diameter sizes used include 2-inch, 6-inch, 8-inch, and 12-inch. The pipe diameter assumed was based on reducing the velocity, and therefore pipe flow-related pressure losses, during the maximum day plus fire flow conditions.

Connections for potable water will be included in the construction of marinas, park models/cabins/yurts, comfort stations, fish cleaning stations, standard sites with full hookups for utilities, day use sites, and any other structure with water needs. For tent only campsites, water spigots will be located nearby, with approximately one spigot for every ten tent sites. Fire hydrants will be located, as required, within 250 ft of any fire department access road.

### 3.1.2 Wastewater Treatment

The following are wastewater assumptions used in design of wastewater facilities. These assumptions will be further refined in future design.

- Wastewater flows and loads assumptions
  - Wastewater design flows were assumed to be equivalent to the potable water demand
  - All facilities are occupied on peak season weekends
  - Occupation rates on non-peak season weekends are 10 – 80 percent of peak season weekends occupation, depending on the month. These values are based on actual occupation rates from existing recreation areas around Lake Berryessa
  - Occupation rates on weekdays are 10 – 30 percent of weekend occupation, depending on the month. These values are based on studies performed at recreation areas similar to those at Lake Berryessa
  - Assumed that the total annual infiltration and inflow into the collection system would be equivalent to 25 percent of the total annual wastewater flows
  - Biological oxygen demand (BOD) concentration in wastewater was assumed to be 500 milligrams per liter (mg/l). It should be noted that municipal wastewater typically has a BOD concentration below 400 mg/l. Wastewater from campgrounds typically has higher BOD concentrations than municipal wastewater. Therefore, the BOD concentration was assumed to be higher than what is typically found in municipal wastewater.
  - Wastewater from RV dump stations will be hauled to an offsite facility for treatment
- Effluent criteria assumptions (The effluent criteria are based on the criteria for the existing Napa Berryessa Resort Improvement District (NBRID) and Lake Berryessa Resort Improvement District (LBRID) wastewater facilities):

- 50 mg/l BOD
- 35 mg/l Total Nitrogen (TN)
- Facultative pond sizing assumptions
  - Ponds will be lined
  - Maximum loading of 50 pounds (lbs) per acre per day
  - Side slopes = 2:1
  - Freeboard = 2 ft
  - 10 ft wide access road will be provided around each pond
- Water balance assumptions
  - 100-year precipitation = 74.1 inches per year (value reported in the water balance calculations included in the Napa Berryessa Resort Improvement District (NBRID) Report of Waste Discharge Technical Report prepared by Summit Engineering)
  - Pond evaporation = 0.76 times pan evaporation
  - Pan evaporation rates were assumed to be equivalent to the rates reported for Lake Berryessa by the Western Regional Climate Center at: <http://www.wrcc.dri.edu/htmlfiles/westevap.final.html>
  - Evapotranspiration rates were based on rates reported in the water balance calculations included in the NBRID Report of Waste Discharge Technical Report prepared by Summit Engineering
  - Field percolation = 0.10 inches per day
  - It was assumed that the storage ponds would be empty at the end of the dry season in September
  - It was assumed that the total annual inflow and infiltration was equal to 25 percent of the total annual wastewater design flows.
- Spray field setbacks
  - 25 ft from a spray field to a property boundary
  - 30 ft from a spray field to a public road right of way
  - 100 ft from a spray field to a domestic water supply well

- 100 ft from a spray field to a residence
- 100 ft from a spray field to public parks, playgrounds, school yards, or similar place of potential public exposure
- Septic tank design
  - 24 hour detention time

## 3.2 Putah Canyon Recreation Area

### 3.2.1 Potable Water Supply

A groundwater well installed at Putah Canyon will be used to meet all of the potable water needs of the area. The groundwater pump station was designed with a flow rate of 23 gpm and a total dynamic head (TDH) of 240 ft to be able to pump from the assumed groundwater level to the highest reservoir elevation.

The water needs for fire protection were based on Napa County's Municipal Code. The square footage of the largest building, the marina, was used to determine the necessary storage capacity (6,000 gallons) and flows (200 gpm for 60 minutes) for fire protection using Table 3-1.

The water distribution system will be comprised of HDPE pipe in various diameters (12-inch and 6-inch) placed primarily in the proposed roadway. Because of the elevations of Putah Canyon, there will not be enough water pressure at certain locations from a gravitational water system a booster pump station will be needed, located near the south eastern corner of the marina parking lot. The booster pump station will house two smaller 2.5 horsepower (HP) pumps (one duty and one standby, sized for a flow rate of 50 gpm and TDH of 70 ft) for peak hour flows and two larger 10 HP pumps (one duty and one standby, sized for a flow rate of 300 gpm and a TDH of 70 ft) for fire flows. The preliminary design criteria for the water distribution system are summarized in Table 3-2.

**Table 3-2. Putah Canyon Water Facility Design Criteria**

Parameter	Units	Value
Groundwater & Water Distribution System Design Criteria		
Groundwater Well Production Yield	gpm	23
Potable Water Max Day Demand	gpd	17,800
Required Fire Flow Demand (for 60 minutes) <sup>1</sup>	gpm	200
Required Fire Flow Storage <sup>1</sup>	gallons	6,000
Water Storage Design Criteria		
Total Potable Water Storage	gallons	50,000
Depth	ft	20
Inside Diameter	ft	21

<sup>1</sup>Fire flow demand and storage numbers were developed using Table 3-1 of this report for sprinkled systems.

### 3.2.2 Wastewater

Wastewater generated in the recreation area will be collected using a Septic Tank Effluent Pumping (STEP) system. Wastewater will drain into several two-chambered, pre-cast concrete septic tanks located approximately 3 feet below ground. A package duplex grinder pump station will be dedicated to each septic tank. The pump station will be used to pump the effluent from the septic tank to the treatment facilities. The piping between the pump stations and the treatment facilities will be HDPE.

The wastewater treatment facility at Putah Canyon will consist of two facultative treatment ponds, followed by a treated effluent storage pond, and an effluent disposal spray field. Preliminary drawings of the wastewater treatment facility are included in Appendix A. The two treatment ponds will have a volume of 640,000 gallons at a depth of 4 ft. The two ponds would treat the wastewater in series, with wastewater flowing from one pond to the next, prior to its discharge into the storage pond. The storage pond will have a volume of 1.6 million gallons (MG) at a depth of 12 ft. Treated wastewater will be stored in this pond prior to its delivery to the 1.3 acre spray/leach field area.

The preliminary design criteria for the wastewater treatment facility are summarized in Table 3-3.

**Table 3-3. Putah Canyon Wastewater Facility Design Criteria**

Parameter	Units	Value
<b>Design Flows &amp; Concentrations</b>		
Average Annual Daily Flow	gpd	2,800
Maximum Monthly Flow	gpd	7,400
Maximum Daily Flow	gpd	17,800
Influent BOD Concentration	mg/l	500
<b>Treatment Pond</b>		
Volume	gallons	640,000
Depth	ft	4
Number of Ponds	-	2
Side Slope	ft/ft	2
Freeboard	ft	2
Width of Access Road	ft	10
Total Footprint (including access roads)	acre	0.9
<b>Storage Pond</b>		
Volume	MG	1.6
Depth	ft	12
Number of Ponds	-	1
Side Slope	ft/ft	2
Freeboard	ft	2
Total Footprint (including access roads)	SF	0.8
<b>Sprayfield</b>		
Area	acre	1.3

**Table 3-3. Putah Canyon Wastewater Facility Design Criteria**

Parameter	Units	Value
Total Footprint		
Area	acre	3.0

### 3.3 Monticello Shores Recreation Area

#### 3.3.1 Potable Water Supply

A groundwater well installed at Monticello Shores would be used to meet all of the water needs of the area. The groundwater pump was designed with a flow rate of 77 gpm and a TDH of 240 feet to be able to pump from the assumed groundwater level to the highest reservoir elevation.

The water needs for fire protection were based on Napa County's Municipal Code. The square footage of the largest building, a comfort station, was used to determine the necessary storage capacity (6,000 gallons) and flows (200 gpm for 60 minutes) for fire protection were determined.

The water distribution system will be comprised of HDPE pipe in various diameters (8-inch, 6-inch, and 2-inch) placed primarily in the proposed roadway. Because of the elevations of Monticello Shores, there will not be enough water pressure at certain locations from a gravitational water system; a booster pump station will be needed, located south of the wastewater treatment pond near the comfort station along the main road. The booster pump station will house two smaller 1.5 HP pumps (one duty and one standby, sized for a flow rate of 50 gpm and TDH of 50 ft) for peak hour flows and two larger 6 HP pumps (one duty and one standby, sized for a flow rate of 300 gpm and a TDH of 50 ft) for fire flows. The potable water system extends throughout the site except for the peninsula of tent-only sites on Monticello Shore Infrastructure Plan IV. Visitors to these site can access potable water from spigots throughout the recreation area, with the closest water spigot being just north of the boat trailer parking lot. The preliminary design criteria for the water distribution system are summarized in Table 3-4.



**Table 3-4. Monticello Shores Water Facility Design Criteria**

Parameter	Units	Value
<b>Groundwater &amp; Water Distribution System Design Criteria</b>		
Groundwater Well Production Yield	gpm	77
Potable Water Max Day Demand	gpd	26,800
Required Fire Flow Demand (for 60 minutes) <sup>1</sup>	gpm	200
Required Fire Flow Storage <sup>1</sup>	gallons	6,000
<b>Water Storage Design Criteria</b>		
Total Potable Water Storage <sup>2</sup>	gallons	50,000
Depth	ft	20
Inside Diameter	ft	21

<sup>1</sup>Fire flow demand and storage numbers were developed using Table 3-1 of this report for sprinkled systems.

### 3.3.2 Wastewater

Wastewater generated in the recreation area will be collected using a STEP system. Wastewater will drain into several two-chambered, pre-cast concrete septic tanks, located approximately 3 feet below ground. A package duplex grinder pump station will be dedicated to each septic tank. The pump station will be used to pump the effluent from the septic tank to the treatment facilities. The piping between the pump stations and the treatment facilities will be HDPE.

The wastewater treatment facility at Monticello Shores will consist of a package treatment plant, storage ponds, and an effluent disposal spray field. Preliminary drawings of the wastewater treatment facility are included in Appendix A. The package treatment plant will consist of screening, an aerated biological reactor tank, a solids separation tank, blowers, recirculation pumps, and other ancillary systems, controls, and instruments. The package system will be constructed of pre-fabricated steel tanks and equipment mounted on skids. The tanks and skids will be delivered to the site and mounted on a concrete pad. The package system will be approximately 40 ft long by 10 ft wide. The storage pond will have a volume of 850,000 gallons at a depth of 12 ft. Treated wastewater will be stored in this pond prior to its delivery to the 1.8 acre spray/leach field area.

The preliminary design criteria for the wastewater treatment facility are summarized in Table 3-5.

**Table 3-5. Monticello Shores Wastewater Facility Design Criteria**

Parameter	Units	Value
<b>Design Flows &amp; Concentrations</b>		
Average Annual Daily Flow	gpd	4,300
Maximum Monthly Flow	gpd	11,100
Maximum Daily Flow	gpd	26,800
Influent BOD Concentration	mg/l	500
<b>Package Treatment System</b>		
Footprint	ft <sup>2</sup>	400
<b>Storage Pond</b>		
Volume	gal	850,000
Depth	ft	12
Total Footprint (including access roads)	acre	0.5
<b>Sprayfield</b>		
Area	acre	2.3
<b>Total Footprint</b>		
Area	acre	2.8

The wastewater collection system will be comprised of HDPE pipe in various diameters (1.25-inch, 2-inch, 3-inch, and 4-inch) placed primarily in the proposed roadway. For Monticello Shores, the required wastewater collection system extends through the northern portion of the recreation area, shown of Monticello Shores Infrastructure Plans I and II in Appendix A. The southern portion of the recreation area does not require wastewater collection system in an effort to reduce capital costs, but it is an authorized service.

## 3.4 Berryessa Point Recreation Area

### 3.4.1 Potable Water Supply

Similar to the Putah Canyon and Monticello Shores recreation areas, a groundwater well will be installed at Berryessa Point to meet all of the water needs of the area. The groundwater pump was designed with a flow rate of 47 gpm and a TDH of 270 feet to be able to pump from the assumed groundwater level to the highest reservoir elevation.

The water needs for fire protection were based on Napa County's Municipal Code. The square footage of the largest building, a comfort station, was used to determine the necessary storage capacity (6,000 gallons) and flows (200 gpm for 60 minutes) for fire protection were determined.

The water distribution system will be comprised of HDPE pipe in various diameters (6-inch and 2-inch) placed primarily in the proposed roadway. Because of the elevations of Berryessa Point, there will not be enough water pressure at certain locations from a gravitational water system; a booster pump station will be needed, located near the proposed groundwater well site. The booster pump station will house two smaller 1.5 HP pumps (one duty and one

standby, sized for a flow rate of 50 gpm and TDH of 50 ft) for peak hour flows and two larger 6 HP pumps (one duty and one standby, sized for a flow rate of 300 gpm and a TDH of 50 ft) fire flows. The preliminary design criteria for the water distribution system are summarized in Table 3-6.

**Table 3-6. Berryessa Point Water Facility Design Criteria**

Parameter	Units	Value
Groundwater & Water Distribution System Design Criteria		
Groundwater Well Production Yield	gpm	47
Potable Water Max Day Demand	gpd	6,100
Required Fire Flow Demand (for 60 minutes)	gpm	200
Required Fire Flow Storage	gallons	6,000
Water Storage Design Criteria		
Total Potable Water Storage	gallons	10,000
Depth	ft	20
Inside Diameter	ft	10

<sup>1</sup>Fire flow demand and storage numbers were developed using Table 3-1 of this report for sprinkled systems.

### 3.4.2 Wastewater

The wastewater design flows for Berryessa Point are summarized in Table 3-7. The wastewater from this facility will drain to one or more vaults, located approximately 3 feet below ground, where it would be stored. Wastewater will be pumped from the vaults periodically and hauled to an offsite treatment facility.

**Table 3-7. Berryessa Point Wastewater Design Flows**

Parameter	Units	Value
Design Flows		
Average Annual Daily Flow	gpd	1,000
Maximum Monthly Flow	gpd	2,600
Maximum Daily Flow	gpd	6,100

## 3.5 Spanish Flat Recreation Area

### 3.5.1 Potable Water Supply

The Spanish Flat Recreation Area will be supplied potable water by the Spanish Flat Water District, which would, without additional support, be able to meet the capacity and pressure requirements of max day and fire flow conditions. There are two existing water storage tanks on site that may be used to store potable water onsite.

The water distribution system will be comprised of HDPE pipe in various diameters (12-inch, 6-inch, and 2-inch) placed, primarily in the proposed

roadway. Water spigots will be located near campsites, with approximately one spigot for every ten campsites. The preliminary design criteria for the water distribution system are summarized in Table 3-8.

**Table 3-8. Spanish Flat Water Facility Design Criteria**

Parameter	Units	Value
Potable Water Max Day Demand	gpd	9,100
Required Fire Flow Demand (for 60 minutes)	gpm	200
Required Fire Flow Storage	gallons	6,000

### 3.5.2 Wastewater

Wastewater generated in the recreation area will be collected using a STEP system. Wastewater will drain into several two-chambered, pre-cast concrete septic tanks, located approximately 3 feet below ground. A package duplex grinder pump station will be dedicated to each septic tank. The pump station will be used to pump the effluent from the septic tank to the treatment facilities. The piping between the pump stations and the treatment facilities will be HDPE.

The wastewater treatment facility at Spanish Flat will consist of a package treatment plant, storage ponds, and an effluent disposal spray field. Preliminary drawings of the wastewater treatment facility are included in Appendix A. The package treatment plant will consist of screening, an aerated biological reactor tank, a solids separation tank, blowers, recirculation pumps, and other ancillary systems, controls, and instruments. The package system will be constructed of pre-fabricated steel tanks and equipment mounted on skids. The tanks and skids will be delivered to the site and mounted on a concrete pad. The package system will be approximately 40 ft long by 10 ft wide. The storage pond will have a volume of 270,000 gallons at a depth of 12 ft. Treated wastewater will be stored in this pond prior to its delivery to the 0.6 acre spray/leach field area. The wastewater collection system will be comprised of HDPE pipe in various diameters (1.25-inch, 2-inch, and 3-inch) placed primarily in the proposed roadway. The preliminary design criteria for the wastewater treatment facility are summarized in Table 3-9.

**Table 3-9. Spanish Flat Wastewater Facility Design Criteria**

Parameter	Units	Value
<b>Design Flows &amp; Concentrations</b>		
Average Annual Daily Flow	gpd	1,500
Maximum Monthly Flow	gpd	3,800
Maximum Daily Flow	gpd	9,100
Influent BOD Concentration	mg/l	500
<b>Package Treatment System</b>		
Footprint	SF	400
<b>Storage Pond</b>		
Volume	gal	270,000
Depth	ft	12
Total Footprint (including access roads)	acre	0.3
<b>Sprayfield</b>		
Area	acre	0.6
<b>Total Footprint</b>		
Area	acre	0.9

## 3.6 Steele Canyon Recreation Area

### 3.6.1 Potable Water Supply

The Steele Canyon Recreation Area will be supplied potable water by NBRID, which would, without additional support, be able to meet the capacity and pressure requirements of max day and fire flow conditions.

The water distribution system will be comprised of HDPE pipe in various diameters (12-inch, 6-inch, and 2-inch) placed, primarily in the proposed roadway. Water spigots will be located near campsites, with approximately one spigot for every ten campsites. The preliminary design criteria for the water distribution system are summarized in Table 3-10.

**Table 3-10. Steele Canyon Water Facility Design Criteria**

Parameter	Units	Value
Potable Water Max Day Demand	gpd	31,200
Required Fire Flow Demand (for 60 minutes)	gpm	200
Required Fire Flow Storage	gallons	6,000

### 3.6.1 Wastewater

Wastewater generated at Steele Canyon will be collected using a STEP system. Wastewater will drain into several two-chambered, pre-cast concrete septic tanks, located approximately 3 feet below ground. A package duplex grinder pump station will be dedicated to each septic tank. The pump station will be used to pump the effluent from the septic tank to the treatment facilities. The piping between the pump stations and the treatment facilities will be HDPE.

Wastewater from the Steele Canyon Recreation Area will be pumped to the NBRID treatment facility for treatment. The NBRID wastewater treatment facility has the capacity to receive up to 15,000 gallons per day from the Steele Canyon recreation area. As shown in Table 3-11, the maximum daily flows from Steele Canyon exceed 15,000 gpd. The maximum daily flows would only be achieved on weekend days during the peak season (approximately 22 days a year). The flows during all other times will be below 15,000 gpd. Flows in excess of 15,000 gpd would be either be treated by a small onsite septic system or stored onsite and discharged to the NBRID facility when wastewater flows fall below 15,000 gpd. The wastewater collection system will be comprised of HDPE pipe in various diameters (1.25-inch, 2-inch, 3-inch, and 4-inch) placed primarily in the proposed roadway. The design wastewater flows for Steele Canyon are summarized in Table 3-11.

**Table 3-11. Steele Canyon Wastewater Facility Design Criteria**

Parameter	Units	Value
Design Flows		
Average Annual Daily Flow	gpd	5,000
Maximum Monthly Flow	gpd	12,900
Maximum Daily Flow	gpd	31,200

# Chapter 4

## Electrical Infrastructure Design

This chapter describes conceptual electrical services and infrastructure at each of the recreation areas.

### 4.1 Design Criteria and Assumptions

Electrical services to each facility will be provided from existing overhead primary distribution lines, which will be extended as required to new transformer locations. New 240/120V, 1 phase, 3 wire transformers will serve new distribution panels at each facility generally as described below. The distribution panelboards will serve the tent/RV areas and other facilities. Electrical service wire from the transformer to the panel will be copper routed in PVC conduit. Using copper wire helps reduce voltage drop from the transformer to the panel and enables smaller wire sizes than aluminum wire.

Direct buried aluminum wire provides power from panels to RV pedestals. Aluminum wire is substantially cheaper than copper wire even when the wire size is increased due to voltage drop. Each of the RV pedestals will be on a circuit. Wiring will be routed in common trenches as much as possible. The wire will be sized so the voltage drop is less than 3 percent from the panel to the pedestal.

In most cases, copper wiring in conduit will be provided to other site related electrical equipment. Conduit provides protection and enables the wire to be replaced if needed.

The following are electrical utility demand assumptions used in conceptual infrastructure design, which will be further evaluated in future design.

- The current utility service, Pacific Gas & Electric, has sufficient power supply for all of the campgrounds' demand of new electrical loads and services.
- Electrical power can be accessed from any part of the utility line.
- Transformers and power feed systems can be located in most locations on the site.

## 4.2 Putah Canyon Recreation Area

Proposed electrical infrastructure at Putah Canyon includes 7 transformers and meters. Three of the transformers will feed power to the park models and RV sites plus the accessible entry station on the east side of Knoxville Road and the comfort stations within proximity of the RV sites. One transformer will feed power to the marina complex including retail and restaurant uses and other loads within proximity. One transformer will feed power to the boat repair building, the adjacent accessible entry station on the west side of Knoxville Road and the employee housing area. One transformer feeds power to two comfort stations and a fishing cleaning station. Septic tank pumps will be powered from the same transformer as comfort stations. An additional transformer will be provided for groundwater pumps. The 2011 National Electric Code allows site feeders and service entrance conductors to be reduced based upon the number of RV sites. The following is a list of the transformers, panels, and equipment proposed at Putah Canyon:

**Transformer 1:** 75KVA transformer feeding 400 amp panel P1. Panel P1 provides power to the following equipment:

- 4 RV power pedestals: 50/30/20 amp
- Comfort Station Subpanel: 125 amp
  - Provides power to lights, receptacles, electric heater and water control panel.

**Transformer 2:** 100KVA transformer feeding 400 amp panel P2. Panel P2 provides power to the following equipment:

- 5 RV power pedestals: 50/30/20 amp
- Comfort Station Subpanel: 60 amp
  - Provides power to lights, receptacles (electrical outlets), electric heater and water control panel.
- Comfort Station Subpanel: 60 amp
  - Provides power to lights, receptacles, electric heater and water control panel.
- Fish Cleaning: Power for grinders, receptacle or light, 500 watt.

**Transformer 3:** 75KVA transformer feeding 400 amp panel P3. Panel P3 provides power to the following equipment:

- 9 RV power pedestals: 50/30/20 Amp
- (2) Accessible Entry Station Subpanels: 60 amp



**Transformer 4:** 100KVA transformer feeding 400 amp panel P4. Panel P4 provides power to the following equipment:

- Boat Repair Building Subpanel: 200 amp
- 6 Park Models: 200 amp
- Concessionaire Office Building

**Transformer 5:** 45KVA transformer feeding 200 amp panel P5. Panel P5 provides power to the following equipment:

- Comfort Station Subpanel: 60 amp
  - Provides power to lights, receptacles, electric heater and water control panel.
- Comfort Station Subpanel: 60 amp
  - Provides power to lights, receptacles, electric heater and water control panel.

**Transformer 6:** 45KVA transformer feeding 200 amp panel P6. Panel P6 provides power to the following equipment:

- Floating Marina Complex Subpanel P7: 200 amp
  - Complex includes small retail counter and restaurant.

**Transformer 7:** 45KVA transformer feeding 200 amp panel P7. Panel P7 provides power to the following equipment:

- Groundwater pumps

### 4.3 Monticello Shores Recreation Area

Proposed electrical service at Monticello Shores includes 6 transformers and meters. Two of the transformers will feed power to RV sites. Three transformers feed power to the accessible entry station, comfort stations, a fishing cleaning station, and other loads within proximity of the subpanels. Septic tank pumps and groundwater pumps will be powered from the same transformer as comfort stations. An additional transformer will be provided for sewer treatment facilities. The following is a list of the transformers, panels, and equipment included at Monticello Shores:

**Transformer 8:** 45KVA transformer feeding 200 amp panel P8. Panel P8 provides power to the following equipment:

- Comfort Station Subpanel: 60 amp

- Provides power to lights, receptacles, electric heater and water control panel.
- Comfort Station Subpanel: 60 amp
  - Provides power to lights, receptacles, electric heater and water control panel.

**Transformer 9:** 45KVA transformer feeding 200 amp panel P9. Panel P9 provides power to the following equipment:

- Storage Tank Pump

**Transformer 10:** 75KVA transformer feeding 400 amp panel P10. Panel P10 provides power to the following equipment:

- 12 RV power pedestals: 50/30/20 Amp

**Transformer 11:** 45KVA transformer feeding 200 amp panel P11. Panel P11 provides power to the following equipment:

- 12 RV power pedestals: 50/30/20 Amp

**Transformer 12:** 45KVA transformer feeding 200 amp panel P12. Panel P12 provides power to the following equipment:

- Fish Cleaning: Power for grinders, receptacle or light, 500 watt.
- Accessible Entry Station Subpanel: 60 amp
  - Provides power to lights, receptacles, electric heater and water control panel.

**Transformer 13:** 200KVA transformer feeding 800 amp panel 13. Panel P13 provides power to the following equipment:

- Wastewater treatment equipment
- Camp host site with utilities
- Park models and cabins

## 4.4 Berryessa Point Recreation Area

Proposed electrical service at Berryessa Point includes 2 transformers and meters. One of the transformers will feed power to the RV site, a groundwater well pump, and a storage tank pump. The other transformer feeds power to the groundwater pump. An additional transformer will be provided for groundwater pumps. The following is a list of the transformers, panels, and equipment included at Berryessa Point:

**Transformer 14:** 75KVA transformer feeding 400 amp panel P14. Panel P14 provides power to the following equipment:

- 9 RV power pedestals: 50/30/20 Amp
- Groundwater Well Pump
- Storage Tank Pump

**Transformer 15:** 100KVA, 480V, 3phase transformer feeding 400 amp panel 15. Panel P15 provides power to the following equipment:

- Booster pump

## 4.5 Spanish Flat Recreation Area

Proposed electrical service at Spanish Flat includes 4 transformers and meters. One of the transformers will feed power to RV campsite areas and comfort stations within proximity of the campsites. One transformer feeds power to comfort stations, the marina retail area, and the package wastewater treatment plant. The other transformer feeds power to the retail shop, comfort stations, accessible entry station, and a fish cleaning station. Septic tank pumps and groundwater pumps will be powered from the same transformer as comfort stations. An additional transformer will be provided for sewer treatment facilities. The following is a list of the transformers, panels, and equipment included at Spanish Flat:

**Transformer 16:** 100KVA transformer feeding 400 amp panel P16. Panel P16 provides power to the following equipment:

- 12 RV power pedestals: 50/30/20 Amp
- Comfort Station Subpanel: 60 amp
  - Provides power to lights, receptacles, electric heater and water control panel.

**Transformer 17:** 45KVA transformer feeding 200 amp panel P17. Panel P17 provides power to the following equipment:

- Floating Marina Subpanel: 200 amp
- Comfort Station Subpanel: 125 amp
  - Provides power to lights, receptacles, electric heater and water control panel

**Transformer 18:** 75KVA transformer feeding 400 amp panel P18. Panel P18 provides power to the following equipment:

- Comfort Station Subpanel: 125 amp
  - Provides power to lights, receptacles, electric heater and water control panel
- Comfort Station Subpanel: 60 amp
  - Provides power to lights, receptacles, electric heater and water control panel
- Fish Cleaning: Power for grinders, receptacle or light, 500 watt.

**Transformer 19:** 45KVA transformer feeding 200 amp panel 19. Panel P19 provides power to the following equipment:

- Wastewater treatment equipment
- Concessionaire park model office building

## 4.6 Steele Canyon Recreation Area

Proposed electrical service at Steele Canyon includes 4 transformers and meters. One of the transformers will feed power to the RV sites. One transformer feeds power to the multiuse special events center building and the accessible entry station. One transformer feeds power to the marina complex including retail and restaurant uses plus park models and comfort stations. The other transformer feeds power to the employee housing area, comfort stations, maintenance and tow service building, and a fish cleaning station. Septic tank pumps and groundwater pumps will be powered from the same transformer as comfort stations. The following is a list of the transformers, panels, and equipment included at Steele Canyon:

**Transformer 20:** 45KVA transformer feeding 200 amp panel P20. Panel P20 provides power to the following equipment:

- 22 RV power pedestals: 50/30/20 Amp

**Transformer 21:** 45KVA transformer feeding 400 amp panel P21. Panel P21 provides power to the following equipment:

- Accessible Entry Station Subpanel: 60 amp
  - Provides power to lights, receptacles, electric heater and water control panel.

**Transformer 22:** 200KVA transformer feeding 800 amp panel P22. Panel P22 provides power to the following equipment:

- Comfort Station Subpanel: 60 amp

- Provides power to lights, receptacles, electric heater and water control panel
- Comfort Station Subpanel: 125 amp
  - Provides power to lights, receptacles, electric heater and water control panel
- Comfort Station Subpanel: 125 amp
  - Provides power to lights, receptacles, electric heater and water control panel
- Restaurant Subpanel: 400 amp
  - Restaurant includes freezers, refrigerators, microwaves, coffee maker, receptacles, lights, furnace, air conditioning condensing unit, and instantaneous electric water heater.
- Marina Complex Subpanel: 400 amp
  - Marina includes freezers, refrigerators, microwaves, coffee maker, receptacles, lights, furnace, air conditioning condensing unit, and instantaneous electric water heater.

**Transformer 23:** 200KVA transformer feeding 800 amp panel P23. Panel P23 provides power to the following equipment:

- Comfort Station Subpanel: 125 amp
  - Provides power to lights, receptacles, electric heater and water control panel
- Comfort Station Subpanel: 125 amp
  - Provides power to lights, receptacles, electric heater and water control panel
- Fish Cleaning 6: Power for grinders, receptacle or light, 500 watt.
- Employee Housing Park Models
- Concessionaire Office Building
- Comfort Station Subpanel: 125 amp
  - Provides power to lights, receptacles, electric heater and water control panel
- Maintenance and Tow Service Shop Subpanel: 200 amp
  - Store includes freezers, refrigerators, microwaves, coffee maker, receptacles, lights, furnace, air conditioning condensing unit, and instantaneous electric water heater.

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